Virginia Department of Agriculture & Consumer Services
Office of Pesticide Services, PO Box 1163, Richmond, VA 23218
Program Coordinator/Registration-(804) 786-4845/Fax (804) 786-9149
Website: www.vdacs.virginia.gov/pesticides

Application for Section 18 Emergency Exemption

Type of Exemption Being Requested

Specific Exemption

Contact Person(s) and/or Qualified Expert(s)

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Description of Pesticide Requested

Common Chemical Name (Active Ingredient): Sulfoxaflor

Brand/Trade Name(s): Transform WG Insecticide **EPA Reg. Nos.: 62719-625**

Formulation: water dispersible granule **% Active Ingredient: 50%**

Manufacturer(s): Dow AgroSciences

Address: Dow AgroSciences LLC, 9330 Zionsville Road, Indianapolis, IN 46268

Notification of Registrant

Letter of Support from Registrant Attached

Name of Pest

Scientific Name: *Lygus lineolaris* (Palisot de Beauvois)

Common Name: Tarnished plant bug

Lygus lineolaris (tarnished plant bug), the most common *Lygus* species in the United States, is a member of the Miridae family within sub-order Heteroptera and order Hemiptera. *Lygus lineolaris* adults are approximately 5 to 6 mm in length, 2 to 3 mm in width, and have flat, yellowish-brown bodies with reddish brown and black mottling, small heads and a long proboscis tucked ventrally at rest. Early nymphal instars are colored light green, late instars are green with a yellowish tint. Originating from the eastern United States, *L. lineolaris* is now the most widely distributed *Lygus* species in North America and is found in all agricultural regions of the continent. *Lygus lineolaris* is a highly polyphagous sap-feeder that has been observed on well over 300 host species and occurs in a wide range of habitats including row and forage crops, orchards, vineyards and nurseries, residential and old fields, margins of forests, fields, roads, and waterways. *Lygus lineolaris* prefer and are most abundant in weedy hosts but transition to cultivated crops under certain conditions (e.g., climatic, host plant development, etc.).

Lygus lineolaris has been a devastating pest in cotton (*Gossypium hersutum* L.) in the Mid-South, Southeast, and parts of Texas for the past several decades. Historically, *L. lineolaris* has been a secondary pest in cotton and was mostly controlled by standard insecticide treatments and management strategies targeted toward cotton boll weevil and cotton bollworm. After 1995, *L. lineolaris* emerged as a major pest in cotton due to reduced insecticide treatments following the introduction of transgenic (*Bacillus thuringiensis*) cotton and the success of the Boll Weevil Eradication Program. Further, *L. lineolaris* populations are capable of developing significant resistance to a wide-variety of common insecticides (e.g., pyrethroids, organophosphates, carbamates, cyclodienes and acephate).

Annual cotton losses and management costs associated with *Lygus* pests throughout the United States continue to cost growers hundreds of millions of dollars each year. Although only a small portion of those losses are felt in Virginia, annual infestations of *L. lineolaris* have occurred since 2010 and continue to intensify. In response, the percentage of cotton acres sprayed for *L. lineolaris* in Virginia has increased dramatically in the past few years and nearly all acres were sprayed 2016-2018. Given the sudden rise of *L. lineolaris* in Virginia, the northernmost cotton-growing region in the United States, additional registered insecticides are desperately needed to efficiently and sustainably manage this pest and to prevent insecticide resistance issues.

Description of Proposed Use

Sites to be treated (i.e., crops, structures, etc.): cotton fields infested with tarnished plant bug, *Lygus lineolaris*

Statewide or County specific (list counties): Virginia cotton growing counties including Mecklenburg, Brunswick, Greenville, Southampton, Isle of Wight, Suffolk, Chesapeake, Surry, Sussex, Emporia, Franklin, Dinwiddie, Prince George, Charles City, King William, King and Queen, Petersburg, and Northampton.

Method of application: Foliar (ground or air)

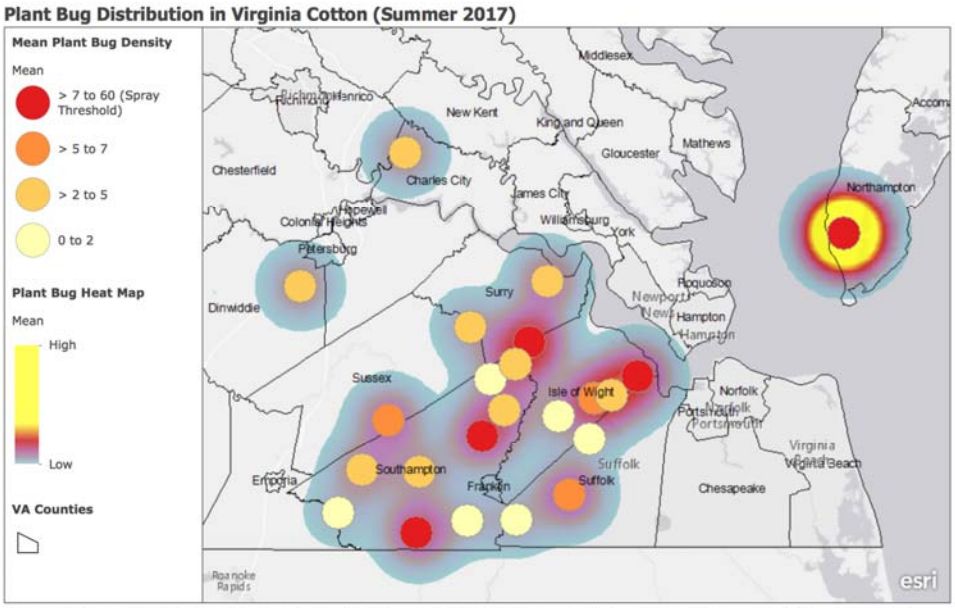
Rate of application in terms of active ingredient (a.i.): 1.5-2.25 oz/acre (0.047-0.071 lb AI/acre).

Annual use not to exceed 8.5 oz/acre or 0.266 lb AI/acre.

Frequency/Timing of Application: As needed when tarnished plant bug are present in fields. No more than four applications per season are allowed. There is a minimum of five days required between applications.

Maximum number of applications: Four applications per acre per year, not to exceed 0.266 lbs active ingredient/acre.

Total acreage (or other units) to be treated: Cotton is grown in southeastern Virginia. There is potential to treat any infested fields where cotton is grown. Any or all of cotton acres may require treatment for tarnished plant given its statewide range (Fig. 1). There are approximately 60,000-100,000 cotton acres in Virginia each year.



Plant bug densities were calculated by sampling four sweet net samples (25 sweeps per sample) and four drop cloth samples across each field. Total adults and nymphs in a single visit were totaled and averaged over the sampling period.

Figure 1. Average density of tarnished plant bug in Virgnia cotton fields in 2017. Fields were scouted weekly. All fields (n=27) contained tarnished plant bug at some point in the growing season (Jun – Aug). Fields in red averaged above threshold numbers (>7 bugs per 100 sweeps). A similar pattern was observed in 2018 except plant bug density was higher.

Total amount of pesticide to be used (in terms of a.i. and product): If 100,000 acres of cotton were grown in Virginia (Currently, this is the estimated acreage. In 2018, there were 97,000 acres grown), it is possible, though unlikely, that all acres will be treated four times. Thus, a total of 8.5 oz. of formulated product would be used, or 6,640 gallons, statewide. In terms of active ingredient, a maximum of 0.266 lbs may be applied per acre. Thus, 26,600 lbs of sulfloxaflor could be applied in Virginia per year under the most extreme scenario. We are requesting the exemption for up to 100,000 acres.

Use Season/Duration of use (period of time for which use of chemical is requested:

Date First Application Needed: June 1, 2019
Date Last Application Needed: October 1, 2019

Restricted Entry Interval (REI): 24 hours

Preharvest Interval (PHI): 14 days

Earliest possible harvest dates: October 2019

Additional Restrictions, User Precautions & Requirements, Qualifications of Applicators, etc.:

Refer to the Transform WG container label for first aid, precautionary statements, directions for use and conditions of sale and warranty information. It is a violation of federal law to use this product in a manner that is inconsistent with all applicable label directions, restrictions and precautions found in the container label and this supplemental label. Both the container label and this supplemental section 18 quarantine exemption label must be in the possession of the user at the time of application.

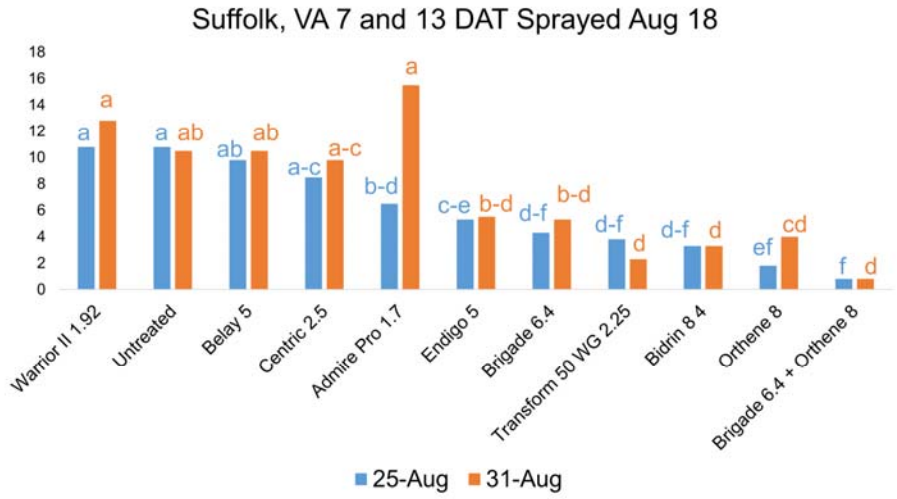
Alternative Methods of Control

Registered Alternative Pesticides: There are multiple classes of insecticides registered for tarnished plant bug control. Several have documented resistance issues. Rotation between insecticide classes is one of the most effective resistance management strategies. Since Virginia fields average two insecticide applications per year for this pest, it is imperative that multiple modes of action, including sulfoxaflor, be made available to growers.

Insecticides registered in Virginia include:

1) Pyrethroids – Resistance to this class has been documented in the Midsouth (Arkansas, Louisiana, Mississippi, and Tennessee) and insecticide resistance forms the basis for Mississippi's Section 18 application. North Carolina crop consultants, including those that cover territory in Virginia, have reported field failures of pyrethroid products. Lambda-cyhalothrin (the active ingredient in Warrior II) performed no better than the control in spray tests performed in Suffolk in 2017 (Figure 2). Resistance assays performed by Dr. Sally Taylor's lab on populations collected from Virginia indicated that bifenthin resistance may already have developed in tarnished plant bug populations (Table 1).

Tarnished plant bug nymphs per drop cloth sample (2 rows/sample). Tidewater AREC, Suffolk, VA, 2017. Insecticide treatments were applied on August 18.



Means within a column followed by the same letter(s) are not significantly different (LSD, P=0.05).

Figure 2. Results of an insecticide efficacy test performed in Suffolk, VA in 2017. The number of tarnish plant bugs recorded seven days (blue) and thirteen days (orange) after treatment is shown on the y-axis. Insecticide product and rates are shown on the x-axis. Plots sprayed with Warrior II, a pyrethroid insecticide commonly used in Virginia, contained similar or higher numbers of plant bugs as untreated plots. Plots sprayed with Admire Pro, a neonicotinoid insecticide favored by Virginia growers, contained similar or higher numbers of plant bugs as untreated plots two week following its application.

Table 1. Mortality response of adult *L. lineolaris* to technical grade sulfoxaflor (99.5% purity), bifenthrin (98% purity), thiamethoxam (99.5% purity), and acephate (99.5% purity) for collections made from weedy hosts in June 2018. Ten concentrations were used in geometric progression for each test that ranged from 0.025 to 102.4 µg/vial. Data was corrected for control mortality using Abbott's formula. Note resistance ratios for Suffolk, VA populations (highlighted in yellow) to bifenthin and acephate. There was no difference in susceptibility to sulfoxaflor nor thiamethoxam between Suffolk, VA populations and a known susceptible laboratory strain.

Location	Host type[a]	Insecticide	*n*	LC_{50}	95% C.L.	RR_{50} [c]	Slope (SE)	χ^2,df	P>χ^2
Auburn, AL	Weeds	Sulfoxaflor	100	0.060	0.016-0.114	-	2.02 (0.64)	2.32, 6	0.888
Madison, AL	Weeds	Sulfoxaflor	100	0.226	0.139-0.363	-	1.72 (1.1)	3.12, 8	0.926
Prattville, AL	Weeds	Sulfoxaflor	100	0.190	0.102-0.322	-	1.60 (0.29)	2.90, 7	0.894
Plymouth, NC	Weeds	Sulfoxaflor	100	0.505	0.299-0.858	-	1.43 (0.23)	4.96, 8	0.762
Florence, SC	Weeds	Sulfoxaflor	100	0.414	0.292-0.754	-	1.16 (0.20)	3.19, 8	0.922
Suffolk, VA	Weeds	Sulfoxaflor	170	0.315	0.207-0.456	-	1.57 (0.21)	16.9, 15	0.326
Auburn, AL	Weeds	Bifenthrin	100	0.021	0.007-0.038	-	1.60 (0.41)	4.68, 8	0.791
Madison, AL	Weeds	Bifenthrin	200	0.100	0.0649-0.148	2.15	1.27 (0.16)	24.9, 18	0.127
Centre, AL	Weeds	Bifenthrin	100	0.376	0.182-0.785	8.07	1.0 (0.19)	7.5, 7	0.382
Prattville, AL	Weeds	Bifenthrin	100	0.292	0.154-0.521	6.27	1.26 (0.24)	7.3, 7	0.398
Plymouth, NC	Weeds	Bifenthrin	280	0.194	0.122-0.296	4.16	0.885 (0.11)	21.1, 26	0.738
Florence, SC	Weeds	Bifenthrin	100	0.076	0.026-0.157	1.63	0.880 (0.19)	3.47, 8	0.901
Suffolk, VA	Weeds	Bifenthrin	180	0.348	0.191-0625	7.47	1.20 (0.20)	25.0, 16	0.070

Auburn, AL	Weeds	Thiamethoxam	100	0.217	0.108-0.390	-	1.16 (0.21)	5.30, 8	0.726
Madison, AL	Weeds	Thiamethoxam	100	0.022	0.002-0.047	-	1.37 (0.41)	4.48, 8	0.811
Centre, AL	Weeds	Thiamethoxam	110	0.059	0.030-0.080	-	1.86 (0.37)	2.90, 9	0.967
Prattville, AL	Weeds	Thiamethoxam	100	0.023	0.011-0.036	-	2.25 (0.58)	3.78, 8	0.877
Plymouth, NC	Weeds	Thiamethoxam	100	0.212	0.112-0.349	-	1.58 (0.31)	3.24, 7	0.862
Florence, SC	Weeds	Thiamethoxam	100	0.194	0.115-0.312	-	1.67 (0.29)	1.98, 8	0.982
Suffolk, VA	Weeds	Thiamethoxam	190	0.139	0.094-0.198	-	1.53 (0.20)	12.8, 17	0.749
Centre, AL	Weeds	Acephate	120	13.3	4.3-93.8	3.02	1.08 (0.29)	24.7, 10	0.006[b]
Plymouth, NC	Weeds	Acephate	220	13.0	6.48-35.7	2.95	0.676 (0.10)	15.0, 10	0.132
Florence, SC	Weeds	Acephate	100	0.358	0.125-1.18	-	0.620 (0.16)	4.47, 8	0.812
Suffolk, VA	Weeds	Acephate	230	14.1	8.15-28.4	3.20	1.10 (0.20)	20.3, 13	0.088

[a] Weedy hosts mostly included Asteraceae and Onagraceae species (i.e., daisy fleabane, cutleaf evening-primrose)

[b] P-value for Pearson goodness-of-fit is <0.05 (i.e., model may not be a good fit for the data)

[c] Resistance ratios (RR_{50}) calculated using a susceptible lab strain from Dr. Fred Musser's Lab at Mississippi State University

2) Neonicotinoids – Neonicotinoid insecticides are recommended for plant bug control pre-bloom in Virginia. Efficacy of these products declines after cotton blooms (Figure 2). There are also legal issues in regards to spraying neonicotinoid products when bees are foraging. Resistance may also be an issue

3) Dicrotophos – an organophosphate insecticide. This product also provides stink bug control and is a viable alternative for plant bug control in terms of efficacy (Figure 2). Dicrotophos products carry high risks for human handlers. As an EPA category I insecticide, dicrotophos products have the signal word "danger – poison", the highest risk category. Likewise, dicrotophos has a long re-entry interval (5 days) which may interfere with other cotton production needs.

4) Novaluron (Diamond) – an insect growth regulator. Novaluron targets only immature plant bugs. Both adult and immature plant bugs damage Virginia cotton and this product must be tank mixed with another insecticide when adults are present in the field.

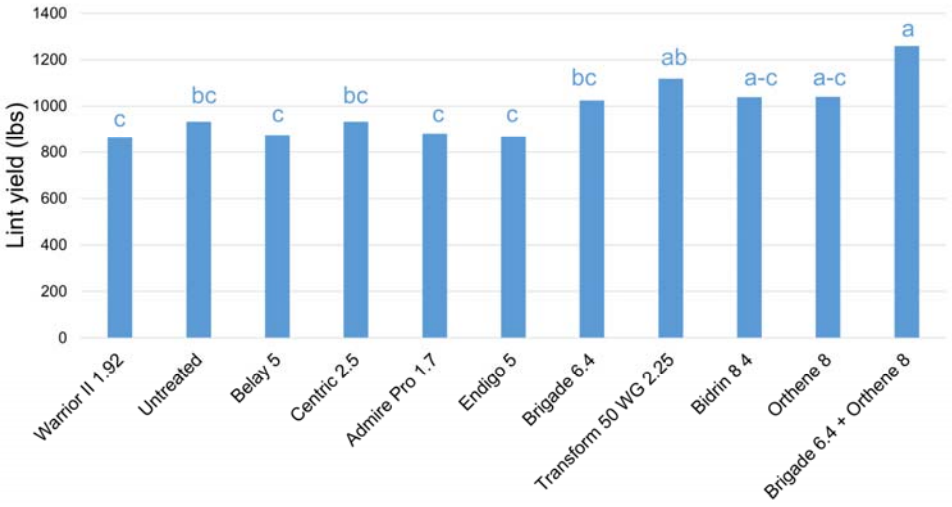
5) Flonicamid (Carbine) – registered for use in Virginia, efficacy of this product is variable in Mississippi and North Carolina, as documented in Section 18s in these states.

6. Acephate (Orthene) – a commonly used product in Virginia for thrips control, acephate provides good control in research trials. Resistance is an issue or will likely become an issue with this product. Assays on Virginia tarnished plant bug populations indicate that very high resistance ratios are present (Table 1). Orthene synergizes pyrethroid products and fits into an insecticide rotation. It should not be used as a sole means of tarnished plant bug control in Virginia.

Alternative Control Practices: Early planting and high plant populations may help lessen economic damage by delaying infestations, but are not stand-alone practices. Biological controls (e.g., predators, parasites) are not capable of reducing populations below economic thresholds prior to economic damage accruing. There are no resistant cotton varieties.

Efficacy of Use Proposed Under Section 18

In terms of efficacy, Transform WG provides excellent control of tarnished plant bug in Virginia cotton (see Figure 2 hereinabove). Lint yields from Virginia efficacy tests (Figure 3) indicate that there is an economic return using Transform for tarnished plant bug control. Note that insecticides were applied in this test only once when tarnished plant bug populations were highest (2-3 times threshold) and economic damage had likely already accrued. Thus, if insecticides had been applied earlier, greater economic gain would have been measured. Transform WG protected yield as good as any product tested and better than all neonicotinoids (Admire Pro, Belay, Centric) and one pyrethroid (Warrior II). Though these data represent only year one results, they indicate that tarnished plant bug control is critical to Virginia cotton farmers and that Transform WG is a valuable product in an insecticide rotation.



Means within a column followed by the same letter(s) are not significantly different (LSD, P=0.05).

Figure 3. Lint yield by insecticide product applied for tarnished plant bug control. No other insecticides, other than early-season thrips protection, were used in this experiment. Experiment was conducted in Suffolk, Virginia in 2017.

Discussion of Risk Information

(Potential risks to human health, endangered or threatened species, beneficial organisms, and the environment)

Please see the attached information from Dow AgroSciences.

Possible risks posed by the user: Transform WG is designated as a category II pesticide (i.e.,

designated at "moderately toxic" in terms of acute toxicity).

From the label:

DANGER
Corrosive. Causes Irreversible Eye Damage. Harmful If Swallowed. Do not get in eyes or on clothing.

Proposals to mitigate risks:

From the label:
Applicators and other handlers must wear:
• Long-sleeved shirt and long pants
• Shoes plus socks
• Protective eyewear

Discard clothing and other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them. Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

Coordination with Other Affected Federal State, and Local Agencies

Under the Virginia Pesticide Control Act, the Virginia Department of Agriculture & Consumer Services (VDACS) is the state lead agency for pesticide regulation. VDACS will be responsible for enforcing the Emergency Exemption. VDACS has provided a copy of this request to several state agencies including the Virginia Department of Game and Inland Fisheries, and the Virginia Department of Health.

Enforcement Program

Include Description of the Enforcement Program, and Procedures for assuring Compliance:

Enforcement of regulations related to a specific exemption is the responsibility of the Virginia Department of Agriculture and Consumer Services. Reports of beneficial effects and any adverse effects arising from the proposed use of the pesticide under the exemption will be obtained by the Virginia Cooperative Extension and provided to VDACS.

Information regarding currently available approved use directions, all restrictions, and precautions in use of these products will be distributed to growers by the Virginia Cooperative Extension, which has offices in every county in Virginia, through mailings, electronic mail, popular media, grower meetings, and/or field days as appropriate. Growers will be required to have a copy of the Section 18 label in their possession when mixing and applying any materials used under this exemption. Growers' pesticide application records will include any materials used under this exemption.

Repeat Uses

This is the second year that Virginia has applied for this use. It was submitted and withdrawn in

2018 (no authorization).

Discussion of Events or Circumstances Which Brought About the Emergency Condition

In the 1990s, cotton was reintroduced in Virginia following successful eradication of the boll weevil. Cotton acreage in Virginia is small compared to other states in the cotton belt (i.e., < 100,000 total acres in 2018. For comparison, neighboring North Carolina contained 375,000 acres in 2017). Cotton is a valuable commodity in Virginia. Prices per pound for cotton are projected to increase in 2019. Cotton is an attractive plant to insect herbivores, and losses to insects can be total (i.e., 100%) if cotton is not managed for pests. Extension recommended thresholds for tarnished plant bug in Virginia are 8 bugs per 100 sweep net samples or 2-3 bugs per drop cloth sample. Tarnished plant bug are highly mobile and may infest fields quickly and re-infest following insecticide applications.

Tarnished plant bug has been present in the United States for many years. It became problematic for cotton growers following the introduction of Bt cotton varieties and successful eradication of the boll weevil. For reasons unknown, tarnished plant bug infestations appeared in Virginia in 2010 and have since accelerated (i.e., increased in frequency and severity). Most Virginia cotton fields require two or more applications of insecticides to control this pest below economically damaging levels. Infestations in Virginia may occur anytime in June – September and frequently occur during the early weeks of bloom, a critical period when fruit (i.e., squares, blooms, bolls) are set that determine final lint yield.

Discussion of Economic Loss

Tarnished plant bug feeding has resulted in economic losses of 20% or greater in Virginia cotton in 2016 (Figure 4) and 2017 (Figure 5 and Table 2). Transform WG is not the only product capable of controlling tarnished plant bug in cotton, but it will be vital in preserving insecticide susceptibility (see Table 1 hereinabove) and thus, cotton profitability. Virginia growers are in direct competition with growers from other states (e.g., Mississippi, North Carolina) that have this compound available to them through Section 18 exemptions. With documented resistance to multiple modes of action in laboratory assays, it is imperative that Transform be made available to Virginia growers as soon as possible.

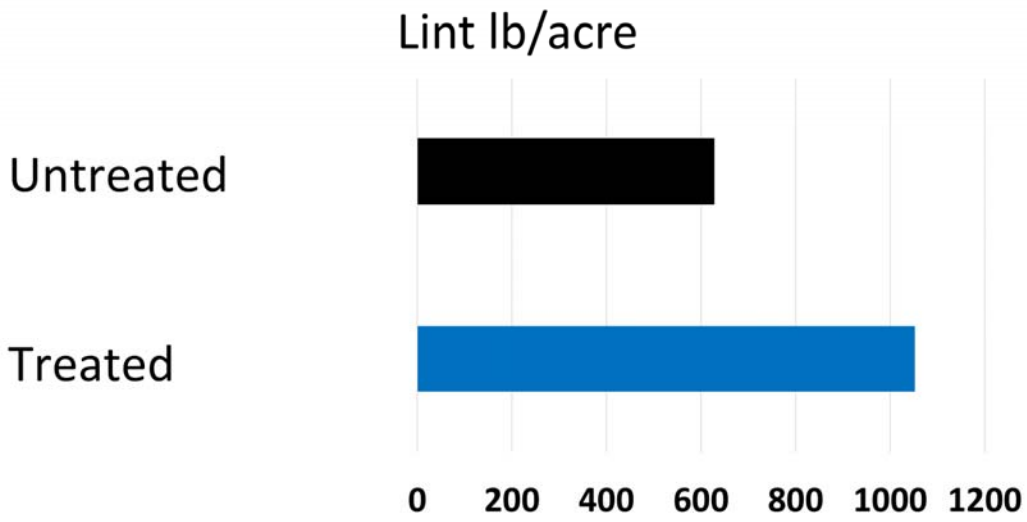


Figure 4. Lint yield (lbs per acre) of cotton treated and untreated with insecticides for tarnished plant bug in 2016 in Suffolk, Virginia. There was a 40% reduction in lint yield when this insect was not controlled.

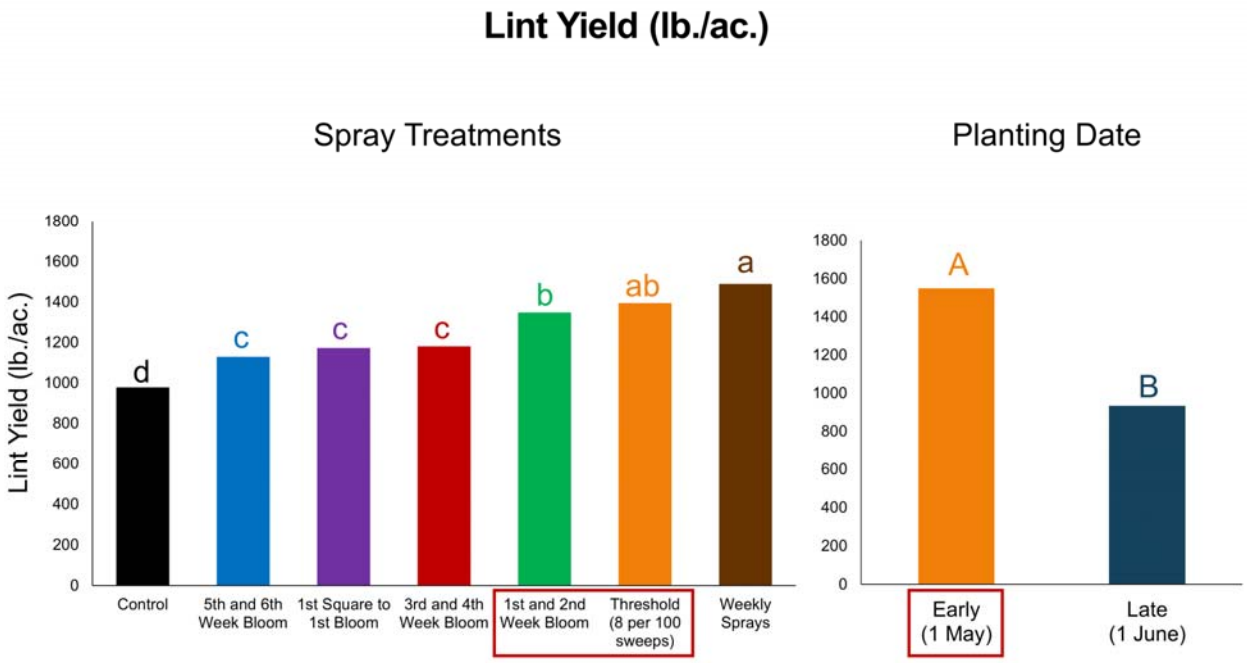


Figure 5. Lint yield from plots treated for tarnished plant bug at different times of the growing season. Yields were highest when plant bugs were treated during the first two weeks of bloom, at threshold, and weekly. There was over a 400 lb yield loss when tarnished plant bug was not controlled. Planting date is an important consideration - losses were greater in late-planted cotton.

Economic Gains of Threshold Sprays

Net economic gains per hectare above late planted control plots. Calculated using $0.73/ha cotton price and $7.56/ha treatment cost in 2017.

	Early Planted		Late Planted	
Treatment	**Sprays**	**Net above control**	**Sprays**	**Net above control**
Control	0	-	0	-
Threshold	4	$799.29	3	$314.41
Prebloom	3	$525.10	3	$232.59
1st to 2nd	2	$798.27	2	$259.49
3rd to 4th	2	$664.61	2	$122.09
5th to 6th	2	$698.81	2	$3.77
Full	8	$835.60	8	$362.57

Table 2. Economic benefit of controlling plant bugs during different times of the growing season in late planted cotton. Based on trials conducted in Suffolk, Virginia in 2017.